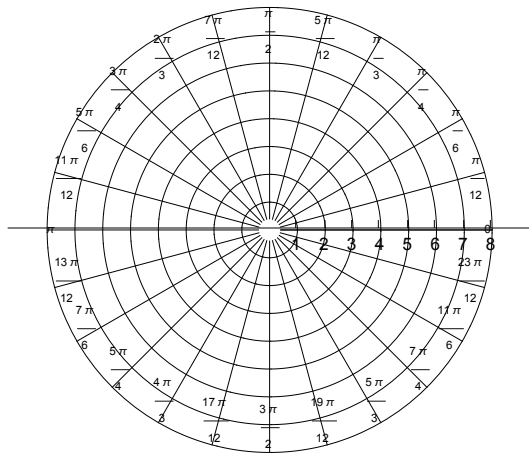


8.1 Polar Coordinates

💡 A point (x, y) in the rectangular coordinate system can be also be written in what is termed **polar coordinates**. The center $(0, 0)$ is called the pole, and the positive x axis is

Example 1 Plot the points:

- (a) $P\left(6, \frac{\pi}{3}\right)$ (b) $P\left(-5, \frac{5\pi}{6}\right)$ (c) $P(3, -75^\circ)$ (d) $P(-4, 45^\circ)$



Conversion Between Rectangular and Polar Coordinates

$$x = r \cos(\theta)$$

$$y = r \sin(\theta)$$

$$x^2 + y^2 = r^2$$

$$\tan(\theta) = \frac{y}{x}$$

Example 2 Convert the following polar coordinates into rectangular.

- (a) $P\left(4, \frac{2\pi}{3}\right)$ (b) $P(-6, 30^\circ)$ (c) $P(5, -15)$

Example 3 Find the polar coordinates for each of the given rectangular points.

- (a) $R(3, 6)$ (b) $R(-4, -7)$ (c) $R(5, -5)$

Converting Functions between Rectangular and Polar Coordinates

A function in polar coordinates is usually written in the form $r = f(\theta)$.

Example 4 Find the equation of the line $y = 3x - 4$ in polar form.

Example 5 Find the equation of the parabola $y = x^2$ in polar coordinates.

Example 6 Find the equation of (a) the vertical line $x = 2$, and (b) the horizontal line $y = -4$.

Example 7 Identify the graph of the polar equation $r = 4 \cos(\theta)$ by converting to rectangular coordinates.

Example 8 Identify the graph of the polar equation $r = 5$ by converting to rectangular coordinates.